

Amazon Doesn't Produce 20% of Earth's Oxygen

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Q: Does the Amazon produce 20% of the world's oxygen?

A: No. Scientists estimate the percentage is closer to 6 to 9%, and the Amazon ultimately consumes nearly all of that oxygen itself.

FULL QUESTION

Does the Amazon Rainforest truly produce 20% of the Earth's oxygen? Where does the remaining 80% come from?

FULL ANSWER

On Aug. 20, Brazil's space agency sparked a media frenzy when it [released](#) satellite data showing an alarming number of wildfires in the Amazon rainforest over the past year — [nearly 40,000](#), or a 77% rise compared with the same time period in 2018.

Most of the fires have started since [June](#). NASA also has [confirmed](#) the surge, declaring 2019 the worst year for wildfires in the region since 2010. Scientists attribute the uptick in fires to [increased deforestation](#), at least some of which, critics say, has been encouraged by Brazil's president, Jair Bolsonaro.

As news outlets across the globe picked up the story, journalists began to spread the false but catchy factoid that the Amazon produces 20% of the world's oxygen. [ABC](#), [CNN](#) and [Newsweek](#), among [others](#), cited the statistic.

Politicians then joined in, repeating the factoid to draw attention to the blazes. For instance, Sen. Kamala Harris, a Democratic presidential candidate, shared the number and suggested it was even higher. "The Amazon creates over 20% of the world's oxygen and is home to one million Indigenous people," she said in an [Aug. 23 tweet](#).

French President Emmanuel Macron also quoted the statistic in an [Aug. 22 tweet](#) calling for world leaders to address the fires at the Group of Seven summit. (His tweet was accompanied by an [outdated photo](#) of a burning forest from 1989.)

Readers, too, have asked us if the statistic is true. Despite its near ubiquity online following the announcement of the Amazon fires, scientists say the 20% figure is overblown. Not only is the number too high by at least half, but it also obscures the fact that the Amazon consumes almost all of the oxygen it produces.

As [Gordon Bonan](#), a senior scientist at the National Center for Atmospheric Research in Colorado, told us, “Oxygen is a red herring.” Bonan said he’s been hearing the 20% factoid for at least a decade. It’s so pervasive, he’s even overheard it being said to schoolkids on tours at his workplace.

“People want to talk about the impact of deforestation,” he said. “Somehow they’ve latched on to this idea that forests create oxygen. That’s not what deforestation is doing.”

The Amazon isn’t critical because it makes oxygen for humans to breathe — that was largely done by [phytoplankton](#) in the sea over millions of years. Instead, it’s because of the area’s rich biodiversity, its vast stores of carbon and the way the forest influences the local and global climate.

A Better Estimate

Shortly after media outlets, politicians and others began to share the 20% factoid, scientists knew the number was far too high, and a few shared their own calculations to correct the record. On Twitter, environmental scientist and executive director of the [nonprofit](#) Project Drawdown, [Jonathan Foley](#), [estimated](#) that the Amazon produces around 6% or less of the planet’s oxygen.

Across the pond, [Yadvinder Malhi](#), an ecologist at the University of Oxford who specializes in the Amazon rainforest, came up with [9%](#).

Bonan said that both numbers are essentially the same and are “within the ballpark of uncertainty” for the calculation.

Both rely on estimates of how much photosynthesis — or what scientists call [primary production](#) — tropical forests do, relative to the total amount done on land and the ocean. During photosynthesis, plants and other organisms, such as aquatic algae, take in carbon dioxide, and with water and a bit of sunlight, create carbohydrates and release oxygen. As a result, the amount of photosynthesis performed is proportional to the amount of oxygen created.



The exact numbers vary, but according to a [study](#) Foley did in 1995 and a more recent [2010 Science paper](#) Malhi referenced, tropical forests do approximately a quarter to a little more than a third of all photosynthesis on land. The Amazon makes up about half or less of all tropical forests, so it alone does about 12-16% of all land photosynthesis. As Malhi writes in a [blog post](#) that addresses this question, rounding that higher-end figure up might be where the 20% factoid came from.

But that's still only considering photosynthesis from land plants. The ocean accounts for about [half](#) of all photosynthesis, which means that only about 6-9% of the world's oxygen, and perhaps less, is produced by the Amazon.

"With a little more analysis and a more thorough review of the literature, we could probably derive a slightly better estimate with more specific uncertainties," said [Scott Saleska](#), a University of Arizona [ecosystem ecologist](#) who agreed with the 6-9% approximation.

But, Saleska said, the exact percentage doesn't really matter because the Amazon, just like any other ecosystem, ends up consuming nearly all of the oxygen it makes. Perhaps surprisingly, plants suck up about [half or more](#) of the oxygen they produce as they, like humans, respire, using oxygen to break down carbohydrates to grow and survive in the inverse reaction to photosynthesis. People associate respiration with animals, but plants do it too — it's just not usually detectable to scientists until nighttime, when plants have stopped pumping out oxygen, NCAR's Bonan said.

The remaining half or so of the Amazon's oxygen is consumed by other creatures, mostly microorganisms, which help decompose fallen leaf litter, dead wood and other rainforest debris. In this way, Malhi explains in his [blog post](#), the net contribution of the Amazonian ecosystem to the world's oxygen level is "effectively zero."

Earth's Oxygen Origins

So where does the Earth's oxygen come from, if not from plants? The answer is that it has come from plants and other photosynthetic organisms — just ones that died long ago under unique circumstances.

Colorado State University atmospheric scientist [Scott Denning](#) said that for there to be a net oxygen gain, some portion of the photosynthetic material that made the oxygen must never rot.

“The easiest place to do that is at the bottom of the sea, under the mud,” he said in a phone interview. As [phytoplankton](#), or microscopic algae, die, Denning explained, most will be consumed, or rot. But a very small amount will make it all the way down into the depths of the ocean to an oxygen-free environment, where it will be retained for the long-term, eventually forming oil and gas. Because the algae never decomposed, the oxygen it made while it was alive is not offset, thus creating a small amount of extra oxygen. The same preservation process can happen on land with plants to create coal, but it requires special conditions. “The only real place is peat bogs,” said Denning.

Only around one-millionth of all photosynthetic matter ends up buried in this way, Denning said, so in any given year, there’s only a tiny bit of oxygen being created. But over millions of years, that tiny surplus of oxygen added up — and it’s why today’s atmosphere is around [21%](#) oxygen.

No Lack of Oxygen

The sheer amount of oxygen currently in the atmosphere is yet another reason why there’s no need to bemoan the Amazon’s burning out of fear that the planet’s oxygen will dwindle.

It is true that if wide swaths of the Amazon went up in smoke, oxygen levels would fall, but only very, very slightly — and certainly not to levels that would pose a risk to humans. According to [data](#) collected by the Scripps Institution of Oceanography, each year, 19 out of every million molecules of oxygen, or 0.002%, are lost, primarily from burning fossil fuels. But there is so much oxygen in the atmosphere already that these minute changes are inconsequential. [Shanan Peters](#), a University of Wisconsin-Madison geologist, told the [Atlantic](#) that even if every living thing on Earth other than humans burned up, oxygen levels would fall from 20.9% to 20.4%. And according to Denning, it would take millions of years to meaningfully deplete the globe’s oxygen supply.

The notion that failing to preserve tropical rainforests would deplete the Earth’s oxygen goes back to at least [1996](#), when Columbia geochemist and [pioneering](#) climate change researcher Wallace Broecker took the time to [debunk](#) the idea in a university magazine. Broecker, incidentally, was perhaps the [first person](#) to use the phrase “global warming,” and one of the earliest scientists to study the topic.

The concept that oxygen levels are falling, and might be something to worry about, is even older. In a 1970 *Science* [paper](#), Broecker did the math to show that because of the abundance of oxygen already in our atmosphere, the tiny drops expected from burning fossil fuels would have virtually no impact. Even if all fossil fuels were burned, he said, less than 3% of oxygen would be lost. “Claims that this important resource is in danger of serious depletion are not at all valid,” he wrote.

Broecker's nearly half-century-old conclusion [still holds](#) today. There is no need to worry about oxygen declines, either from fossil fuels — which are in fact the plant or plant-like remnants responsible for our abundant stores of oxygen — or from the living, breathing Amazon.

Still Worth Protecting

Even though the Amazon isn't responsible for the oxygen humans breathe, all the scientists we spoke to emphasized that the place is very special, and deserves to be protected.

At the top of the list, said Saleska, is the Amazon's nearly unrivaled biodiversity. "It is a showcase and archive of the genetic endowment of 300 million years of evolution," he said, "the value of which it is impossible to say because we simply don't yet know how to read all the treasure maps that it contains."

The Amazon also fuels the local wet climate, as trees absorb water and then release much of it into the atmosphere as water vapor. This massive-scale recycling of water, Saleska said, provides water to populations in the south and to the agricultural breadbasket of South America, located in central Brazil.

"The big concern is that when some of those trees are lost, that water recycling is cut off at the knees, threatening the integrity of the whole system," he said. "We worry that we will soon cross a threshold of forest loss, a point of no return, after which the water recycling pump will be insufficient to maintain the system and we will see forest collapse independent of further human depredations."

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